# TWO CASES OF PERFORATING GUNSHOT WOUND OF THE KIDNEY.[1]

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CASE I. *Penetrating Gunshot Wound of the Abdomen; Perforation of Kidney and Liver; Exploration; Nephrectomy; Death.*—G. W. L., aged thirty-four, was shot in the abdomen on December 13, 1894, with a revolver of 32-calibre, which was said to have been held in contact with the body by the assailant, who was standing directly in front of him. As the victim was trying to escape, a second shot was fired, which took effect in the back of the right shoulder. The patient was brought to the Lynn Hospital (service of Dr. Pinkham), and fourteen hours after the accident was first seen by me in consultation with the hospital staff.

The chief symptoms were vomiting and abdominal pain. The pulse was 98, not strong; the temperature 100.2° F. The abdomen was rigid; the abdominal muscles, especially the recti, standing out prominently. There was some distention of the epigastrium, but no especial tenderness anywhere in the abdomen. The countenance was pale and anxious.

One and a half inches to the left of the median line, and three and a quarter inches above the umbilicus there was a penetrating gunshot wound surrounded by an area of ecchymosis. The bullet could be felt under the skin, behind the right kidney, near the lumbar spines. The right kidney had evidently been wounded, but it was plain that the internal hæmorrhage, if any existed, was not severe. The rigidity of the abdomen, the vomiting, and the epigastric distention indicated some serious abdominal complication.

[1] Read by title at the meeting of the American Surgical Association, May, 1896.

Though the rate of the pulse was not high, the quality was poor. The temperature, as in most abdominal cases, had little bearing upon diagnosis, prognosis, or treatment. The general condition of the patient, with the local signs—especially the abdominal rigidity—seemed to demand immediate exploration. Moreover, the bullet, if its course was a straight line between the point of entrance and the spot where it could be felt under the skin, could hardly have failed to strike either the transverse colon, the stomach, or the duodenum. Furthermore, the hæmaturia showed clearly that the kidney had been injured. In view of these considerations it was thought best to open the abdomen at once.

A short median incision above the umbilicus showed that there was free blood in the peritoneal cavity; that the anterior wall of the stomach was uninjured; that the transverse colon and left kidney were intact; and that there had been no fæcal extravasation. The incision was then enlarged sufficiently to permit examination of the small intestines, which also were found to be uninjured. The thorough examination which the extended incision made possible showed an infiltrating retroperitoneal hæmorrhage about the pancreas. In the mesentery of the transverse colon there was considerable hæmorrhagic extravasation. The dependent regions of the abdominal cavity were filled with fluid blood. Further exploration demonstrated clearly that there had been no injury to the stomach or the intestines; to the pancreas or the spleen.

It having been ascertained beyond a doubt that the stomach and the intestinal tract were unharmed, that there had been no fæcal extravasation, and that no serious hæmorrhage was going on, the right kidney was exposed. Near the hilum a ragged opening was found, which admitted the tip of the finger. From the hilum the course of the bullet was directly across the cortex to the convex border, where it had emerged and had become lodged under the skin. The renal vein as well as the pelvis of the kidney had been extensively lacerated. Very little if any blood was escaping. It seemed clear that the vitality of the kidney had been destroyed (see Fig. 1). Nephrectomy was immediately decided upon.

The kidney was easily enucleated and removed after its vessels had been tied with silk. The abdominal cavity was carefully cleansed with dry sterile gauze. The patient's pulse continued fair, though weaker than at first. At the very close of the operation the course of the bullet was discovered. There was a wound of entrance in the

anterior surface of *the left lobe of the liver.* The bullet had perforated this lobe, had next ploughed a furrow in the quadrate lobe, and finally had struck and pierced the kidney, as previously described. In the dorsal decubitus the wound of entrance in the liver was at least four inches higher than the point where the bullet had pierced the peritoneum of the anterior abdominal wall. Far from injuring the transverse colon, the duodenum, or even the stomach, the bullet had passed entirely above them; it had not even traversed the free abdominal cavity, except as it passed from the anterior wall directly into the liver, being practically in liver or kidney substance throughout its course.

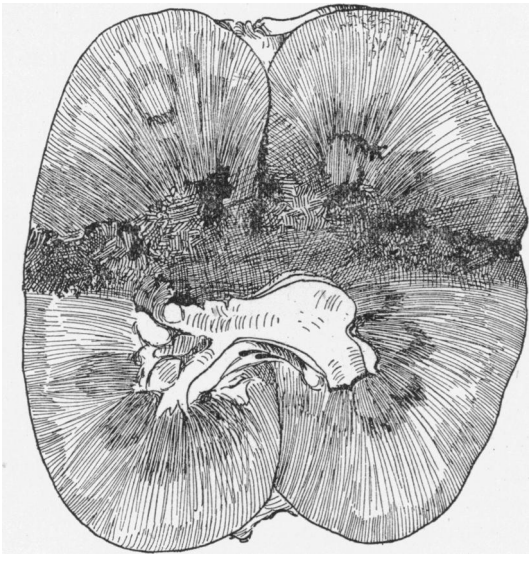

FIG. 1.—Perforating gunshot wound of kidney; appearances presented by the kidney removed in Case I.

No blood was escaping from the wounds in the liver. The abdominal incision was closed without drainage. The bullet was removed from its place of lodgement by a small incision through the skin of the back.

The patient stood the operation well, suffering comparatively little shock. On the following day he was reported as much better; urine was secreted by the other kidney in small amounts; the outlook seemed good. The second twenty-four hours brought unfavorable symptoms. The abdomen became distended; the pulse and

temperature rose; the patient began to vomit. He died forty-four hours after the operation and fifty-eight from the time of injury, having secreted twenty-five ounces of normal urine.

On December 21, Dr. Pinkham wrote, "L. began to fail notably at noon, Saturday. At 4 P.M., Dr. Stevens and myself examined into his condition, and decided that he could not live. We informed him, in order that he might make a statement that could be used in court. At this time his mind was clear. There was sufficient pain to require the use of opiates. The pulse was quick and compressible at 117. Respiration was 50 to 60, with abundant tracheal râles. The abdomen was distended and rigid. He had been vomiting, and nausea was manifest when water was taken. The pain was chiefly in the back. I was inclined to think that these symptoms were due to sepsis, and that the man died promptly when they supervened, because he was weak from shock and hæmorrhage. The wound of the liver which we saw was, as you surmised, in the left lobe. The course of the bullet, as shown by the autopsy, was as follows: through the abdominal wall and the left lobe of the liver about three-quarters of an inch from the anterior margin, and an inch from the longitudinal fissure; thence diagonally across the lower portion of the quadrate lobe (making a furrow); thence through a projecting portion of the right lobe near the middle of its under surface; thence through the kidney and out between the eleventh and twelfth ribs. The left kidney appeared unchanged at the autopsy. Everything connected with the operation was in good condition. There was no sign of pus. The omentum majus and the peritoneal covering of the transverse colon were injected and dark in color. The retroperitoneal extravasations were very dark; elsewhere the peritoneum appeared healthy. The liver did not seem to be swollen, but on section it was slightly grayish in color. There was considerable (perhaps a pint) free liquid—dark-colored blood or very bloody serum—in the peritoneal cavity. In the right pleural cavity was some very bloody serum,—about two ounces. In the left pleural cavity an equal quantity of light red serum. Lungs healthy in color and not congested."

There were no gross appearances of sepsis.

Nephrectomy seems proper and even necessary in cases of violence in which the kidney is so lacerated that its functions cannot be maintained, especially if the peritoneal cavity is in-

volved and liable to contamination. If the course of the bullet is such that the peritoneum is uninjured, there being, therefore, no necessity for abdominal exploration, haste is not imperative, and the patient may consequently be watched for symptoms which may indicate the next step. When a kidney, lacerated by a septic missile is pouring urine into the abdominal cavity, the necessity for exploration seems manifest. If the secretory power of the kidney is not destroyed, and if the pelvis and ureter are still intact, some more conservative procedure than extirpation may be selected. Even under these more favorable conditions it may at times be better surgery to remove entirely the cause of possible sepsis than to endeavor by palliation to save a weakened kidney at the expense of great danger to life.

The foregoing remarks were written not long after the receipt of Dr. Pinkham's letter. The question of saving a kidney that had been the seat of a perforating gunshot wound never again presented itself to me clinically until the occurrence of the second case (March 25, 1896), though it was often a subject of discussion. At least two cases of gunshot wound of the kidney had been treated previously at the Massachusetts General Hospital, both complicated by perforations of the intestine, and both fatal. In the absence of such complications the advisability of nephrectomy in gunshot wounds of the kidney seems easier to decide. A kidney the vitality of which is destroyed by laceration of its artery or its vein should be removed. Is it also imperative to remove a kidney which is so perforated that urine escapes into the peritoneal cavity? It seems to me that the answer should be in the negative unless the circumstances are exceptional; for the harm caused by the extravasation of urine presumably healthy has already been done, and although thorough drainage is essential nephrectomy does not materially promote it. Moreover, by guiding the urinary stream out through the wound of exploration a kidney may often be saved, not only to carry on its functions, weakened though they may be, but also to repair its injuries by spontaneous closure of the renal wound. Furthermore, a laceration involving even a considerable portion of the secreting substance of the kidney may be treated

by resection of the injured tissues with suture, a method of treatment which seems highly commendable in suitable cases. In the event of a permanent urinary fistula efforts at artificial repair may be made, or a subsequent nephrectomy may be performed.

CASE II.—*Penetrating Gunshot Wound of the Abdomen; Perforation of Kidney and Liver; Exploration; Drainage of Kidney; Recovery.* On March 25, 1896,[1] Daniel M., aged thirty-two years, was brought to the Massachusetts General Hospital, having been shot at a dog-fight two or three hours before while trying to escape from the police.

Examination showed a well-developed man. There was marked pallor; the pulse was 90, weak; the temperature was 99° F. (by rectum); the respiration 28, labored. The patient was restless and complained of pain in the epigastrium. The abdomen was rigid, especially over the right upper quadrant, where it was also tender. There was neither vomiting nor expectoration. Urine withdrawn by catheter contained blood. Consciousness was unimpaired. There was a bullet wound of entrance five inches from the lumbar spines, on the right side of the back, on a level with the anterior superior spinous process of the ilium. The bullet could be felt under the skin just below the right anterior superior spine. It was removed and proved to have a calibre of 32.

A second wound of penetration was found in the back, on the right side, at the level of the umbilicus, three inches from the spine. The direction of the wound was upward and forward, and from it there was a slight hæmorrhage.

The patient's distress was conspicuous; respiration was hurried, shallow, labored, and noisy; the hands and feet were cold. Percussion and palpation caused pain. That the right kidney had been injured seemed clear; that there was more or less internal hæmorrhage, certain; that the intestines had been perforated, probable; that there was necessity for exploration, unquestionable.

A vertical incision, nine inches long, was made from the margin of the ribs to the crest of the ilium. The line of incision was parallel to the right linea semilunaris and two inches or more posterior to it. This incision permitted free inspection of the right half of the abdomen,—of the small intestine, the right kidney, the

[1] Massachusetts General Hospital Records, Vol. CCCIX, p. 51.

liver, the gall-bladder, the duodenum, and the pylorus. It permitted also thorough manual exploration of the whole abdominal cavity.

A large amount of free blood was found in the abdomen, and an infiltrating hæmorrhage in the perinephric and retroperitoneal tissues. No intestinal wounds could be detected. The first evidence of gunshot wound that was discovered in the abdomen was a perforation in the under surface of the right lobe of the liver. This opening was ragged and admitted the tip of the index-finger. Its direction was upward and towards the left; there was no bleeding from it.

The capsule of the kidney was next opened and found to contain clotted blood in considerable amounts. This was removed. It was now evident that there had been a serious lesion of this kidney. The abdominal wound was therefore enlarged by a cut beginning in its centre and passing directly backward towards the spine, as far as the vertebral aponeurosis. This enlargement of the wound enabled me to ascertain exactly the damage done the kidney. The bullet had perforated the muscles of the back, had struck the right kidney in the centre of its anterior surface, half-way between the hilum and the convex border; thence it had passed upward, backward, and inward, emerging on the posterior surface about an inch higher than the level of the penetration; thence it had passed into the liver and probably through the diaphragm into the right pleural cavity. The pelvis and the great vessels of the kidney were uninjured.

Most of the house-staff were in favor of immediate nephrectomy. Conservative treatment was finally adopted, however; first, because the vitality of the kidney was shown by visual and by digital examination to be unimpaired; secondly, because a large proportion of active secreting structure remained intact, and, thirdly, because the hæmorrhage could be easily controlled.

The free blood was removed from the abdominal cavity as thoroughly as possible by means of dry gauze. Small strands were placed in both anterior and posterior wounds of the kidney and brought out of the lower angle of the transverse incision. The vertical and transverse incisions were closed. The gauze began immediately to suck out urine and blood.

For the next twenty-four hours the patient was in fair condition. The urine, which he passed in abundance, contained much blood.

On the fourth day he developed pneumonia in the right side, but the wound and the kidney were both doing well. The sterile

gauze was all removed on the sixth day, and the sinus was packed with iodoform gauze.

Four weeks after operation the patient was practically well. The wound had entirely closed. The urine for a time was bloody; then purulent, finally clear and normal.

The patient was discharged well on April 30, 1896.

The two injuries recorded in the foregoing pages closely resemble each other in most of their essential features. In both the weapon and the missile were the same. In both the liver and kidney only were perforated; there was a moderate amount of free blood in the abdominal cavity; there was free retroperitoneal bleeding; the patients' general condition was the same. In both the body of the organ was completely perforated and a portion of its secreting tissue destroyed. In both an extensive exploration preceded local measures. In the renal lesion they differed, however, to an extreme degree. In one the vein and the pelvis were hopelessly lacerated; in the other they were intact. In one a nephrectomy was resorted to, in the other simple drainage. In the former death ensued, in the latter, recovery.

The essential difference, therefore, lies in the nephrectomy, which the more serious lesion rendered necessary in the first case. Had it been possible to preserve what remained of this kidney would not the result, to a reasonable certainty, have been different?

The autopsy showed an absence of the usual signs of sepsis. If sepsis caused death the patient must have succumbed in the very beg nning of the ptomaine absorption, long before the germ colonies had time to show themselves in altered appearances of the peritoneum. In point of fact the autopsy showed that "everything connected with the operation was in good condition. There was no sign of pus. . . . The peritoneum appeared healthy." The left kidney was unchanged to the naked eye.

Assuming that death resulted in this case from the inability of the remaining kidney to carry on successfully the work of excreting urine—the most frequent cause of death after the removal of an active kidney—one cannot but wonder whether the injured kidney might not after all have been saved; whether it

would not have been better simply to drain the kidney in the hope that even if too badly hurt for ultimate recovery, it might, for a time do some of the work of excretion pressing so heavily on the other side; whether gangrene would surely follow laceration of the renal vein, and whether the well-known anomalies of the great vessels of the kidney might not justify the hope that in some way the vitality of the organ might be kept up; whether, finally, it would not be better on the whole to treat conservatively all wounds of the kidney, even the most extensive. Questions like these have been suggested by these two cases. They can be settled only by additional experience.